PATENT APPLICATION
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FLAT-PANEL DISPLAY MOUNTING SYSTEM FOR PORTABLE COMPUTER

BACKGROUND OF THE INVENTION

Portable computers almost universally have a top cover that pivots to open or close over a base unit. The top cover typically houses a flat-panel display, and the base unit has a keyboard and, many times, some form of pointing device.

In most cases, the flat-panel display is supported in the top cover by securing it to a plastic back or rear portion of the top cover. Usually, the flat-panel display has four or more holes around its periphery; bolts extend orthogonally to the face of the display, through the holes, to engage bosses, which are integral with the back. The plastic back is typically structural in nature, being manufactured from a rigid plastic. When connected together, the flat-panel display and the plastic back provide necessary rigidity to the top cover.

The selection of the flat-panel display in portable computers is generally driven by two competing concerns. On one hand, with the availability of ever-larger flat-panel displays, there is a desire to incorporate those displays into newer portable computer designs. Running contrary to this, however, is the desire to limit the overall dimensions of the computers to enhance their portability. For example, it is common to design portable computers with outside dimensions limited to approximately 8 x 11". These dimensions are characteristic of notebook-sized computers.

Various innovations have come about to increase the active or viewing area of the flat-panel display as a proportion of the total surface area of the top cover to obtain larger displays without increasing the computer's overall dimensions. For example, it is known to fold the driving and other peripheral circuitry around to the back of the flat-panel display. This results in a display panel whose surface area is almost entirely active except for the width of the metal rim that holds the display together and the bolt holes that are used to attach the flat-panel display to the plastic back.

SUMMARY OF THE INVENTION

The problem with prior art configurations is the fact that they fail to recognize that the size of the top cover need not be large enough to accommodate the bolt holes. According to the present invention, the flat-panel display is provided with fixtures in the display's sidewalls to provide for its support by lateral mounting members. The advantage of this approach, in which the bolt holes are essentially rotated around to the sides of the flat-panel display, is the reduction in the portion the portable computer's top cover that is not active display. In practice, this results an increase of six millimeters or more in the size display that may be housed in the same-sized top cover.

In specific embodiments, the lateral mounting members comprise bolts that engage bosses in the flat-panel display.

Further reductions in the inactive portions of the top cover may be achieved by extending the ends of the display's fluorescent back-light beyond or through the

metal rim that surrounds the display. This allows the rim to be even thinner.

Also according to the invention, in order to accomodate the lateral mounting of the flat-panel display, metal brackets are used. These brackets extend from the base unit hinges and cradle the display. This adds tortional rigidity, but also removes the requirement that the back must be structural. As a result, the back can simply be a thin, molded cosmetic rear cover for the computer's top cover.

In specific embodiments, the lateral mounting members, or bolts, pass through the brackets and the plastic back to engage the bosses, thus binding the elements to each other.

The above and other features of the invention including various novel details of construction and combinations of parts, and other advantages, will now be more particularly described with reference to the accompanying drawings and pointed out in the claims. It will be understood that the particular method and device embodying the invention are shown by way of illustration and not as a limitation of the invention. The principles and features of this invention may be employed in various and numerous embodiments without the departing from the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale; emphasis has instead been placed upon illustrating the principles of the invention. Of the drawings:

Fig. 1 is a perspective view of a portable computer according to the present invention;

Fig. 2 is an exploded view of the top cover of the portable computer according to the invention;

Fig. 3 is a cross-sectional view of the inventive top cover; and

Fig. 4 is a partial perspective view of a corner of an inventive flat-panel display.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 illustrates a personal computer 10 constructed according to the principles of the present invention. Generally, the computer 10 has a top cover 100 that is connected by hinges 112, or otherwise pivotally attached, to a base unit 12. The top cover 100 houses a flat-panel display 114 and a second, much smaller, status display 116, which typically provides information concerning remaining battery life, disk drive operation, and other house-keeping functions. The base unit 12 has keyboard 14 and a pointing device 16, a touch pad in the illustrated embodiment. A power switch 18 and disk drive door 20 are located on the side of the base unit 12.

The overall dimensions of the particular embodiment illustrated when closed are about 8.5 inches wide by 12 inches long, which dimensions also apply to the top cover 100 and base unit 12 separately. The total closed height is over two inches, with the height of the top cover 100 being approximately 0.5 inches.

The unique characteristics of the present invention are evident in the ratio between the total surface area of the top cover 100 and the surface area of the active or viewable area of the display 114. The active area of the display illustrated is 14.1 inches, diagonally.

Consequently, it consumes over 90% of the top cover's total area.

Fig. 2 illustrates the mounting technique for the display 114 in the top cover 100. Structurally, the top cover 100 comprises a back 118. This component is almost universally constructed from plastic and forms the top outer shell of the portable computer 10 when the top cover 100 is closed. The back 118 is rectangular in shape and forms essentially a tub around the other elements of the top cover. The proximal wall 120 of the back is not present, however, to accommodate the hinge connection to the base unit.

In many prior art designs, the back 118 of the top cover 100 provided significant structural support to the back cover. This fact was evident by the existence of spines or ridges, which are integral with the back, that added rigidity. It is also common to bolt the display to the back by placing bosses in the back during molding. In the present embodiment, only the side walls of the back 118 contribute to the back's bending rigidity, and the back overall has little torsional rigidity.

Rigidity, especially torsional, is added to the top cover by right and left metal brackets 122, 124 that are located in the back. The proximal portion of each bracket 122, 124 connects to respective right and left hinge elements 126, 128 that are adapted to cooperate with corresponding hinge elements in the base unit 12. The brackets 122, 124 are each aligned against respective side walls 130, 132 of the back 118. The cross-section of each bracket is essentially "L"-shaped, the shorter legs 134, 136 extending orthogonally away from the planar inner surface of the back 118 and abutting the back's sidewalls

130, 132. Two holes 138, 140 in each bracket are sized to accommodate bolts 148, 150, 2 millimeters in diameter, and the holes align with corresponding holes 142, 144 through the sidewalls 130, 132 of the back 118. Preferably, the outer surfaces of the back's sidewalls 130, 132 have slight depressions 146 to recess heads of the bolts 148, 150.

The flat-panel display 114 comprises a large active area 152 that is defined by the transparent top window of the display 114. The top window is clamped to the panel's plastic back (not shown in this figure) by a metal rim 154 that extends around the display's circumference, defining the display's bottom (180), left (181), top (182), and right (183) sidewalls. Holes 156, 158, formed in the metal rim 154, that align with the holes in the brackets and back when the display is installed. The four bolts 148, 150 extend through the back 118, brackets 122, 124 to engage bosses held in the display 114 behind the metal rim 154.

A plastic bezel 160 snap fits over the display onto the back. The bezel's rim extends inward hiding the display's metal rim.

Fig. 3 is cross-sectional view further illustrating the back cover's construction. As discussed previously, each of the four bolts 148, 150 extends through the back 118 and corresponding vertical legs 134, 136 of the brackets 122, 124. The bolts 148, 150 further extend through the metal rim 154 of the display to engage corresponding threaded bosses 162 held in the plastic back 164 of the display. Also shown is the snap-fit arrangement of the plastic bezel 160 to the back 118.

Fig. 4 is a detailed view of one of the lower outer corners of the flat-panel display 114 illustrating another

innovation of the invention that enables a more compact display. Usually, the length of the fluorescent back-light plus the thickness of the display's metal rim dictate the overall width of the display. The light emitting portion of the fluorescent light must be as wide as the active area of the display, but electrodes on the end of the light are wider than the small peripheral inactive portion of the display.

According to the present invention, circular cut-outs 166 are formed in the metal rim 154 to allow the ends of the fluorescent light 168 to extend slightly beyond the outer surface of the rim 154. As a result, the overall width of the display is no wider than the critical length of the fluorescent back-light 168. In effect, twice the thickness of the metal rim, since cut-outs 166 are provided for both ends of the light 168, is removed from the overall width of the display without any loss in active area. Defined another way, the inactive portions on both sides of the display are each decreased by the thickness of the metal rim 154 by enabling the ends of the back-light 168 to extend beyond the rim.

In other embodiments of the invention, the bolts 148,150 may be replaced with pins that extend through the back 118 and brackets 122,124 to engage non-threaded holes in the side walls 180-183 of the display 114, possibly using an interference fit. Alternatively, these pins could be integral with the metal brackets 122,124. In this later case, it may desirable to have the display 114 to snap fit with the pins, to facilitate the manufacturing process.

In still another embodiment, pins extend outward from the display 114, possibly integral with the metal rim 154 to engage the brackets 122, 124 with a snap fit

arrangement. This configuration has the advantage that there is no need to accommodate holes in the display which can affect the display's electrical design.

In still other embodiments, mounting could be accomplished off of the top and bottom side walls 180, 182 of the display 114. In this case, lateral mounting members that cooperate with these side walls would be used to replace the mounting fixtures on the right and left side walls 181, 183, or in addition to those fixtures.

While this invention has been particularly shown and described with references to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.